

problem his very thorough acquaintance with a few fundamental principles.

No marks were ever given for lecture notes, but rough laboratory notes and finished accounts of laboratory work in good English, with elaborate sketches and squared-paper curves, were thought most important. When a hundred students pass through laboratories of no large dimensions in one week, some system must be adopted, and the education cannot be ideally perfect, especially when the number of instructors is limited. But great encouragement was given to any student who adventured and discovered things of which he had not been told anything. Advanced students had fine opportunities for original research.

From 1884 until he died Ayrton was professor of electrical engineering at the City and Guilds Central College, South Kensington. The laboratory here became a sort of developed combination of that at Finsbury and the one in Japan. In my opinion, there is no electrical laboratory in the world that can compare with the Kensington laboratory, whether we look at it from the educational or from the research point of view. He always said that much of its success was due to the helpfulness of Mr. Mather.

In dealing with students, that earnestness and enthusiasm and inspiration, that training in scientific method, that sympathy and helpfulness for others which he received from Lord Kelvin, he handed on to many thousands of pupils, and they in turn are handing them on to new generations.

"The Electricians' Directory" speaks of about 150 papers published, usually in collaboration with myself, Mather, and others, in the Proceedings and Transactions of the Royal Society, Physical Society, Institution of Electrical Engineers, and other societies, giving the titles of the most important, and it gives the names of some of the numerous inventions with which Ayrton alone or with others has benefited the world. The time from 1879 to 1884 was a particularly happy one. There are now hundreds of schools where men may learn electrical science; in most of them his pupils are teaching. There are now thousands of electrical engineers in whose employment a man can obtain experience. But at that time there was only one school, there was almost only one office in which and there was almost only one engineer in whose service, education and experience could be found. Every young man of promise, every engineer with ambition, was attracted from Germany, America, and elsewhere to the place where new discoveries and new inventions were the order of the day. It was a glorious time, that pioneering time when everything planted was fruitful, when everything tried was successful. Those discoveries are now such common knowledge, those inventions are such usual parts of all electrical machinery, that nobody dreams of mentioning their author's name in connection with them.

I remember once, in 1886, sitting at a meeting of the Institution of Electrical Engineers beside Prof. Ayrton, and, looking over the large audience, I was able to say that nearly three-quarters of the people present were Ayrton's old students.

He loved the Institution of Electrical Engineers, and it was no wonder, for it was the mirror of his life. It gave a setting and a value to all his life's work and all he cared for. It gave a scope for that energy, that earnestness, that untiring industry, that hatred of inaction which was his most intense characteristic. He was a member of it almost from the beginning; his speeches during discussions form some of the best reading in its proceedings; he was a diligent attender at general meetings, at council meetings, and at meetings of the numerous committees. His love for it was that of a nurse or mother for

the boy whom she has seen grow up to splendid manhood.

Since 1879, when he lectured on electrical transmission of power at Sheffield, Prof. Ayrton delivered many popular lectures, and each of them may be said to have been epoch-making. He acted on many juries and congresses. He was president of Section A of the British Association in 1898, president of the Physical Society in 1890, president of the Institution of Electrical Engineers in 1892. He became a Fellow of the Royal Society in 1881, and in 1901 he was awarded a Royal medal by the Royal Society for his scientific work.

His first wife was his cousin, Matilda Chaplin, one of the famous pioneering Edinburgh medical students; their daughter Edith, now Mrs. Israel Zangwill, was born in Japan. His second wife is well known as the only woman member of the Institution of Electrical Engineers; she was awarded the Hughes medal of the Royal Society for her scientific work in 1906; their daughter Barbara has already published a physiological investigation.

When I first knew him in Japan the motto printed on his notepaper was "Energy." It was his motto through life, or rather his motto was "Earnestness."

He had a keen sense of justice and a high regard for truth. His mere presence often caused the tone of conversation to be raised. The ideals towards which he worked incessantly were noble ideals. In his own lifetime great progress had been made towards their realisation, but occasionally he was despondent, particularly towards the end, when his ailing body could not respond to his vehement spirit. He could not see that all the noble things for which he had worked were being worked for now by numerous energetic young men, most of whom had been inspired by himself. It was sad to watch him towards the end, the active mind warring with the weak body. I felt often that I wanted to say with Kent in the old play, "O, let him pass! He hates him that would upon the rack of this rough world stretch him out longer."

JOHN PERRY.

#### NOTES.

SIR WILLIAM RAMSAY, K.C.B., F.R.S., and Dr. G. W. Hill have been elected corresponding members of the Bavarian Academy of Sciences.

M. LOUIS-FÉLIX HENNEGUY, professor of comparative embryogeny in the Collège de France, has been elected a member of the Paris Academy of Sciences.

MR. JAMES SWINBURNE, F.R.S., has been elected president of the Junior Institution of Engineers, in succession to the late M. Gustave Canet.

WE learn from *Science* that the Nichols medal of the American Chemical Society has been awarded to Prof. W. A. Noyes, of the University of Illinois, and Dr. H. C. P. Weber, for their researches on the atomic weight of chlorine.

THE Royal Statistical Society offers the "Howard medal" (bronze) and a grant of 20*l.* for the best essay on a statistical study of infantile mortality in Great Britain and Ireland and of its causes. The competition is open, and is not limited to Fellows of the Statistical Society. Essays must be sent in before June 20, 1909.

THE eighty-third Christmas course of juvenile lectures, founded at the Royal Institution in 1826 by Michael Faraday, will be delivered this year by Prof. William Stirling, his subject being "The Wheel of Life." The

course, which will be fully illustrated, will commence on Tuesday, December 29, and will be continued on December 31, 1908, January 2, 5, 7, and 9, 1909.

THE fiftieth anniversary of the foundation of the British Ornithologists' Union will be celebrated by a special meeting in the rooms of the Zoological Society on Wednesday, December 9, at 3 p.m. Only four of the original members still survive—Dr. F. Ducane Godman, F.R.S., Mr. Percy S. Godman, Mr. W. H. Hudleston, F.R.S., and Dr. P. L. Sclater, F.R.S.—and at the close of the meeting commemorative gold medals will be presented to them.

At the annual general meeting of the London Mathematical Society, held on November 12, the following were elected to be the council and officers of the society for the session 1908-9:—*President*, Sir William Niven; *vice-presidents*, Mr. A. Berry, Prof. W. Burnside, Prof. H. M. Macdonald; *treasurer*, Prof. J. Larmor; *secretaries*, Prof. A. E. H. Love, Mr. J. H. Grace; *other members of the council*, Dr. H. F. Baker, Mr. G. T. Bennett, Mr. A. L. Dixon, Prof. E. B. Elliott, Dr. L. N. G. Filon, Dr. E. W. Hobson, Major P. A. MacMahon, Mr. H. W. Richmond, Mr. A. E. Western.

A FEW weeks ago Sir J. H. Carruthers directed attention to the fact that there is no monument in London to commemorate the life-work of Captain Cook. Admiral Lord Charles Scott and other representatives of the Royal Navy have expressed cordial approval of the proposal to erect such a monument to the great navigator. "A large number of us have had reason," they add, "when following our vocation, to feel personally grateful to him for the care with which he carried out his explorations and the accuracy of his hydrographical surveys." It is hoped that the proposal to establish some public memorial of Captain Cook will receive generous support from the British public.

THE death of M. Alfred Ditte, professor of inorganic chemistry at the Sorbonne, adds yet another to the long list of losses sustained by the Academy of Sciences during the past year. This distinguished chemist, although not prominently identified with any epoch-making discovery, made numerous important contributions to inorganic chemistry. The pupil of Deville, Ditte's earlier papers furnished experimental material confirming the theory of dissociation. In this connection may be mentioned his work on the formation and decomposition of the hydrogen compounds of selenium and tellurium, and the same idea of the equilibrium of chemical reactions led to his researches on the action of water on antimony chloride, mercuric sulphate, and bismuth nitrate. The conditions governing the artificial production of crystallised minerals were also thoroughly worked out by him, and gave rise to a long series of memoirs. Ditte published no joint papers, his work being entirely personal, and the same individuality was exercised in his professorial work, especially in his laboratory instruction. He was elected a member of the Academy of Sciences in 1897, in succession to Schutzenberger.

THE Government of Madras has approved, we learn from the *Pioneer Mail*, the recommendation of the recent industrial conference that there should be a special department under a special officer to deal with industrial questions. This officer will be styled Director of Industries. In carrying out industrial development the Government considers immediate action is possible as regards the establishment of an industrial museum, the preparation of

a list of manufactures in the Presidency of sufficient importance to justify the establishment of special industrial schools in relation to them, and in other directions. The director is to submit proposals for giving effect to the recommendations of the conference in regard to the establishment of six weaving institutions on the lines of the Manchester or Bradford textile schools at six centres in the Presidency, each under an Indian expert; the employment of a dyeing expert to report on the state of that industry in the Presidency; the establishment of a leather-trade school with a small tannery attached; the offer of a reward for the design of a suitable oil-extracting plant and the introduction of improved oil presses, &c.; and the extension of well-boring operations.

FROM the *Times* of November 14 we gather the following remarks, contributed by a correspondent, upon the work of Dr. James Fletcher, the Dominion entomologist, whose death was announced last week:—So long ago as 1879 Dr. Fletcher was vice-president of the Entomological Society of Ontario and part editor of their annual reports, to which he had contributed a paper on Canadian beetles in the previous year; and from this time until his death he worked hard at Canadian entomology and botany, and published numerous papers and reports, chiefly on economic entomology and on the habits and transformations of insects, in various Canadian journals, especially in the *Canadian Entomologist*, of which he became assistant editor in 1887, about the time that he was appointed Dominion entomologist and botanist to the experimental farms at Ottawa. Here he set himself energetically to combat insect pests, which are far more destructive in the American continent than in Europe, and his exertions were so much appreciated that he was called "the farmers' friend" throughout Canada. Nor did he neglect botany, for he published a "*Flora Ottawensis*" in the *Transactions of the Ottawa Field Club*, vols. i.-v. (1880-4), and again in the *Ottawa Naturalist*, vols. ii.-vii. (from 1888 onwards).

THE first general meeting of the Institute of Metals, formed in June last, was held in Birmingham on November 11 and 12 under the presidency of Sir William White, K.C.B. The institute already has a membership of about 350, and a considerable number of members from all parts of the country attended, and were cordially welcomed by the Lord Mayor of Birmingham (Mr. G. H. Kenrick). The president's address, which dealt with the aims of the institute and the part which manufacturers, users, and scientific investigators may be expected to play in its development, aroused the keenest interest. An excellent list of papers for reading and discussion was forthcoming, the most notable being those by Mr. J. T. Milton and Mr. A. Phillip on the practical side, and by Mr. C. Desch and Mr. W. Rosenhain on the scientific study of non-ferrous alloys. In the majority of cases the papers were adjourned for further discussion at the London meeting on January 19 and 20. It is a matter of congratulation that the Birmingham metal works have interested themselves so keenly in the formation of the institute, and that a strong local committee was formed the invitation of which to hold the first meeting in this important centre of the metal industry was gladly accepted by the council of the institute. Excellent arrangements were made for the reception of members and visitors. Visits to some of the chief metal works were carried through, a reception was held by Sir Oliver Lodge at the new university buildings, followed by an inspection of various departments, and special mention must be made of an exhibit at the

conversazione of upwards of 100 "diseased" metals and alloys which had been collected at the instigation of Mr. Boeddicker, the chairman of the local committee. It is to be hoped that this display of metals and alloys which have failed from obscure causes will lead to much valuable research work being set in hand. Certain it is that in the corrosion of metals the institute has a magnificent field of investigation. The meetings were a pronounced success; the institute has justified its establishment, and now takes its place among the technical institutions of this country.

THE first number of the Bulletin of the Sleeping Sickness Bureau has been published by the Royal Society, bearing date October, 1908, and is edited by the director, Dr. A. G. Bagshawe. It deals with the chemotherapy of trypanosomiasis, and contains a clearly written summary and review of the results hitherto obtained in the treatment with drugs of diseases caused by trypanosomes, with references to 197 memoirs. The subject is dealt with under the headings "Treatment of Trypanosomiasis in Man," "Biological Accommodation of Trypanosomes to Chemotherapeutic Agents," and "Treatment of Experimental Animals," after which the editor draws some conclusions and lays down some principles which, in his opinion, have been established by this vast accumulation of experimental research. The publication is a most valuable one, and will undoubtedly be of great use to those engaged in research or practice in this field by putting clearly before them what has been achieved, and suggesting lines of investigation to be followed.

POLYCHÆTOUS annelids collected off the Pacific coast of North America by the U.S. steamer *Albatross* in 1903 form the subject of a paper by Mr. J. P. Moore in the Proceedings of the Academy of Natural Sciences of Philadelphia for June last. Out of 107 species collected, forty-seven are considered to be new.

AMONG the contents of vol. iii., part i., of the Transactions of the Natural History Society of Northumberland, Durham, and Newcastle-upon-Tyne is a paper by Mr. A. Randell Jackson on rare arachnids captured in Britain during 1907. Three of these are new to the British fauna, two being new species, of which one appears to be indigenous, while the second is introduced; the third is a continental species of the attid or jumping group. Of three other species only one sex had hitherto been recorded in our islands.

SPIDERS likewise form the subject of an article in the *Bulletin international de l'Académie des Sciences de Cracovie* for June, Mr. Vl. Kulczyński treating therein of the Javan and Sumatran representatives of the groups Mygalomorphæ and Cribellatæ. Some of the specimens described were collected at Palembang, in Sumatra, others in the islands of the Batu, Krakatau, and Babo groups, and yet others in Java itself, more especially in the mountains. A considerable number of new species and races is named and described.

STUDENTS of variation should be interested in an elaborate paper by Dr. A. Brožek, of Prague, on the variability and local forms of the decapod crustacean *Palaemonetes varians* from four different localities, published in the *Sitzungsberichte der k. Böhm. Gesellschaft der Wissenschaften* for 1907. Two of the four localities are so far apart as Plymouth and Montenegro, and the variations—in the number and form of the "teeth" of the rostrum—are expressed in figures. It is noteworthy that the variability displays a marked tendency to asymmetry, and the author divides this asymmetrical variation into a "positive" southern and a "negative" northern type.

THE damage caused to cotton in India by the caterpillars of the cotton leaf-roller moth (*Sylepta derogata*, or *multilinearis*) is discussed by Mr. H. Maxwell-Lefroy in *Entomological Bulletin*, vol. ii., No. 6, of *Memoirs of the Department of Agriculture in India*. While this common pest does not, as a rule, inflict much harm on native Indian cotton, it is extremely injurious to introduced American and Egyptian strains, destroying in some instances almost the entire crop. Whether these foreign cottons will eventually become more immune to attack remains to be seen.

THE intra-uterine development of the hedgehog appears to have received but little attention at the hands of embryologists, despite the fact that the group is one of the most ancient of all mammals, and therefore likely to yield interesting results in this respect. As regards the age of the group, it may be mentioned that both the extinct *Necrogymnurus* and the existing *Erinaceus* are represented in the Oligocene phosphorites of central France, the persistence of the second genus being attributed to the defensive coat of spines with which its members are furnished. Recently Mr. H. Jacobfeuerborn has investigated the development of the hedgehog, with especial reference to the time of the acquisition of the external form during intra-uterine life, which he finds to be unusually early. The results of the investigation are published in the *Zeitschrift für wissenschaftliche Zoologie*, vol. xci., part i.

THE relations of the fauna of Central Europe to the Glacial period form the subject of a long and interesting paper by Prof. F. Zschokke, of Basle, published in the *Verhandlungen der deutschen Zoologischen Gesellschaft* for 1908. The paper is illustrated by two of Geinitz's maps, showing the maximum glaciation of North and Central Europe. Although at first bringing death and destruction in its train, the Ice-age should be regarded, in the author's opinion, as a great vivifying factor, exciting the fauna to active and passive migrations, and thus extending the distribution of the various species both on land and in water. The author has much to say regarding the spread in Central Europe of Nehring's "steppe-fauna" from the direction of the Ostsee, and adds that subsequently to this there must have been a great northern post-Glacial migration of southern animals and plants. The article is of such interest as to be well worthy of translation into English.

To the October number (vol. xliii., part i.) of the *Journal of Anatomy and Physiology* Prof. O. C. Bradley contributes an important paper on the morphology and development of the mammalian liver. Basing his conclusions largely on development, the author is of opinion that the liver is primarily an organ of more simple structure than was supposed to be the case by the late Sir W. H. Flower, consisting of three, in place of six, main lobes. The difference between the two views will be rendered most easily apparent by the following table:—

Bradley		Flower.	
Central lobe	...	Right lobule	Right central lobe
		Left lobule	Left central lobe
		Main part	Right lateral lobe
Right lateral lobe	{	Processus caudatus	Caudate lobe
		Processus omentalis or papillaris	
Left lateral lobe			Left lateral lobe

The division of the central lobe into two is dependent on the presence of an "umbilical fissure," and is therefore not primary. The three fundamental lobes make their appearance independently, and develop in connection with different embryonic veins, the central lobe being produced



about the umbilical veins, while the right and left lobes grow along the course of the corresponding omphalo-mesenteric veins. The origin of the hepatic fissures cannot yet be satisfactorily explained.

A PHYTOGEOGRAPHICAL study of the Bonin Islands is contributed by Dr. A. Hattori to the *Journal* (vol. xxiii., art. 10) of the Royal College of Science, Tokyo. Although the average monthly temperature seldom exceeds 27° C., the vegetation is tropical in character, and shows close affinities with the flora of Formosa. A considerable proportion of Indian and Ceylonese plants, consisting largely of coastal plants, suggests the importance of sea transportation. A single endemic genus, *Boninia* (Rutaceæ), is recorded, and thirty endemic species, or about 14 per cent. of the total. The screw-pine, *Pandanus boninensis*, an endemic species, thrives generally, and in one locality forms a pure forest; the palms *Livistona chinensis* and *Ptycosperma elegans* are prominent, also the fern trees *Alsophila Bongardiana* and *Cyathea spinulosa*.

AN impressive volume, copiously supplied with illustrations, has been compiled by Dr. D. T. Macdougall, of the Desert Botanical Laboratory connected with the Carnegie Institution at Washington; he discusses therein the botanical features of the North American deserts. The volume contains the essence of previously published reports on deserts in Texas, Mexico, and California, and concludes with some general remarks on deserts and desert plants. On the subject of temperatures it is noted that in the soil around the roots of plants temperatures were measured up to 43° C., and the readings obtained by inserting the bulbs of thermometers into *Opuntia* stems ranged from 27° C. to 43° C. Again, it was observed that on occasions a difference of 20° C. existed between the temperature of the air and soil surrounding the stem and root of the same plant. These facts, it will be seen, do not harmonise with generally accepted ideas.

WE have received early numbers of the new periodical *Archiv für Zellforschung*, edited by Dr. R. Goldschmidt, intended, as the title implies, for the publication of original communications on cytology. The first part, issued in February, was inaugurated with a paper by Dr. R. Hertwig on modern problems of cell-science, in which he discusses the function of the nucleus and the nature of its influence. He elaborates his theory of a relation existing between the nucleus and the protoplasm, whereby the phenomena of division and other changes in the cell are regarded as a release of the tension set up by a departure from the normal proportion. An important contribution to the same subject is made by Dr. M. Popoff, wherein he details his experiments with Infusoria to obtain data for working out the proportion mentioned. The tabulated curves are of great interest, also the reasoning as to a chemico-physical ultimate cause. Dr. G. Tischler communicates the results of cytological investigations with sterile plant hybrids, but is unable to offer any explanation of the determining influence. Other contributions relate to the chromosomes, the formation of sperms in the Myxinoideæ, and Dr. Goldschmidt traces the chromatin changes in the egg of *Distomum lanceolatum*.

MESSRS. GUSTAV FISCHER, of Jena, have published a very useful and interesting booklet, by Dr. P. Schatloff, explanatory of Ehrlich's "side-chain theory," and illustrated with several diagrams ("Die ehrlichsche Seitenkettentheorie," pp. 56, price 2 marks).

In the *Journal of Comparative Neurology and Psychology* for October (xviii., No. 4) Mr. Judson Herrick discusses

the morphological subdivision of the brain, and suggests a scheme of subdivision of the vertebrate nervous system which he thinks might be tentatively adopted as a terminology available for all vertebrates.

THE *Journal of Hygiene* for September (viii., No. 4) contains several important papers; among others, Mr. Currie discusses abnormal reactions to horse serum in the serum treatment of cerebro-spinal fever, Dr. Green discusses immunity against vaccinia in animals and the influence of temperature on calf vaccine, and Mr. Watson publishes a note on the variation of the rate of disinfection with change in the concentration of the disinfectant.

THE *Bio-Chemical Journal* for October (iii., No. 9) contains a paper by Dr. Owen Williams on the micro-chemical changes occurring in appendicitis. It would appear that in the course of the changes in the intestinal wall an abnormal condition with the formation of calcium soaps is induced. The calcium soaps are absorbed with difficulty, and tend to act as foreign bodies in the wall, and at times as a concretion in the lumen, of the appendix.

RATS and their parasites have assumed considerable importance in the dissemination of plague, also in trichinosis, and Mr. A. E. Shipley, F.R.S., in the *Journal of Economic Biology* (iii., No. 3, October) gives a long list of the ecto- and endo-parasites which infest these animals.

IN 1807 Dr. Francis Buchanan, author of the well-known "Journey through Mysore," was appointed to make a comprehensive survey of Bengal. After about 20,000l. had been expended on the work it was discontinued, and a portion of the MSS., now in the India Office Library, was published by Mr. M. Martin in 1838 under the title of "Eastern India." Even admitting its obvious shortcomings, the book has been of much value to later writers. Mr. H. MacPherson, Director of Land Records, Bengal, has now issued a pamphlet entitled "The Aboriginal Races of the Sonthal Parganas: a Plea for the Reprint of the Buchanan Manuscripts," in which he shows the value of the collection. If the Government of Bengal finds itself unable to re-print the collection *in extenso*, it may be hoped that it will at least publish the portions which Mr. Martin either abbreviated or omitted from his book.

ONE of the most primitive methods of cartography is that employed by the inhabitants of the Marshall Islands. Mr. T. A. Joyce, in the October number of *Man*, describes a chart of this class from the British Museum collection. It consists of a framework of sticks, those which are horizontal and vertical being intended as supports to the map, while the diagonal and curved rods represent the swells raised by the prevailing winds. At the intersections of the rods shells are fixed to denote the islands of the group. Comparison with a modern chart shows that the position of each island with reference to its neighbours is indicated with considerable accuracy. The distances from island to island are not so correctly defined; but this is a matter of minor importance, because the winds in these latitudes being constant at certain seasons the boat can be steered by the swells alone, and its position with reference to the islands can be determined by indications which the practised eye draws from cross-swells and the like. From the fact that the Ralic Archipelago is most accurately charted, it would appear that the maker of this map was a resident in one of the islands of this part of the group.

In the October number of the *Reliquary* Mr. E. H. Goddard discusses the objects of the Bronze age which have been found in Wiltshire. It is remarkable that a

district which at the earlier period of the Bronze age was densely peopled should possess so few examples of the later period, when men no longer buried their weapons with the dead. The writer suggests as an explanation of this that Wiltshire possesses neither large rivers, like the Thames, nor turbaries and bogs, such as those of Somerset, Devon, and the north of England, situations where such relics are most abundantly found. The chalk downs of Wiltshire offered few opportunities for the loss of such things or for their preservation so late as our time. Even granting this, the absence of founders' hoards, except one from Donham, now in the Farnham Museum, remains unexplained. Socketed celts and palstaves are fairly numerous, but swords, except one doubtful example in the Devizes Museum, are conspicuously absent. One dagger found at Winterbourne Bassett resembles those found in the Swiss lake-dwellings. The socketed sickle from Winterbourne Monkton is an unusual form of the implement, rare in any form in Great Britain, and almost unknown on the Continent, where sickles without sockets are the rule. In Ireland, however, they are more common. A socketed gouge, again, is an example of a type uncommon in England. It seems obvious that the conditions of the Wiltshire Bronze-age people differed in some respects from that of the race in other parts of this country, and the abnormal types to which Mr. Goddard directs attention may have been the result of some foreign influence or may have been imported. His article supplies good illustrations of these abnormal local implements.

THE present month has experienced very exceptional changes of temperature, although for the most part the weather has remained mild for the time of year. During the first week the thermometer stood high over the whole country, and in many parts of England the days were more like spring than late autumn. A decided change of temperature occurred about November 7, and for the two or three subsequent days the thermometer fell to an abnormally low reading. At Greenwich the first frost of the season was registered by the sheltered thermometer on November 10, and the thermometer fell to  $22^{\circ}$ , which is lower than any previous reading during the first half of November since 1841, whilst on the grass the exposed thermometer registered  $9^{\circ}$ . The weather report issued by the Meteorological Office for the week ending November 14 shows that similarly low readings occurred in other parts of the kingdom between November 8 and 11, the sheltered thermometer registering  $16^{\circ}$  in the east of Scotland,  $17^{\circ}$  in the Midland counties, and  $18^{\circ}$  in the east, south-east, and south-west of England. On the grass the lowest readings were  $7^{\circ}$  at Llangammarch Wells,  $9^{\circ}$  at Greenwich,  $12^{\circ}$  at West Linton,  $13^{\circ}$  at Birmingham,  $14^{\circ}$  at Newton Rigg and Kew, and  $15^{\circ}$  at Canterbury, Oxford, Buxton, and Dumfries. There was a rapid rise of temperature between the mornings of November 10 and 11, amounting to  $30^{\circ}$  at Oxford,  $25^{\circ}$  at Nottingham, and  $23^{\circ}$  at Bath. The subsequent weather has been very mild for the time of year.

THE monthly meteorological charts of the North Atlantic and Indian Oceans issued by the Meteorological Office, and the chart for the North Atlantic issued by the Deutsche Seewarte, for November, 1908, have been received. The charts issued by both countries contain practically similar useful information, and show on their face the normal values of the principal meteorological elements, the best routes for sailing vessels and steamships, the average limits of trade winds for the month in question, together with the latest reports of ice in the Atlantic and of the south-west monsoon in the Indian Ocean. On the backs of the

charts are given average statistics of fog in the Atlantic, of ice in the Southern Ocean, and other information of importance to seamen. The charts are published during the month prior to that to which the data refer; they are compiled from all available sources at the disposal of the various meteorological and hydrographic offices, and deal with some thousands of observations. The labour involved is very onerous, but the value of the work, brought up to current time, cannot be over-stated.

AMONG several useful articles contained in the U.S. *Monthly Weather Review* for June last, recently received, we find a note by Prof. Cleveland Abbe suggesting the importance of establishing a graduate school of meteorology on the principle of that established by the Association of American Agricultural Colleges, in which lectures and experiments by specialists bring home to interested audiences the present state of agricultural knowledge. The third session of this school was held at Ithaca in July last; the "seminar" forms a predominating part of the work, in which the instructor undertakes to show students how important items of knowledge have been obtained, and replies to questions that may be put. Referring to meteorology, Prof. Abbe says:—"At present we rely too much on books and letters; we shall do better to get together, ask questions, try experiments, and compare notes." In this country a great step in this direction is made by the director of the Meteorological Office by continuing during the present winter season the series of meetings commenced in 1905 for the informal discussion of important contributions to meteorological literature, particularly those by colonial and foreign meteorologists. To these meetings contributors of observations to the office, and, so far as space permits, others known to be interested in meteorology, receive invitations to be present, and to take part in the discussions. We also note that in a recently published report of a departmental committee appointed by the Board of Agriculture the opinion is expressed that in agricultural institutions provision might well be made for instruction respecting the relations between meteorology and the crops.

THE October issue of the *Journal of the Institution of Electrical Engineers* contains a communication, made to the institution in May by Mr. G. F. Mansbridge of the Post Office, on the manufacture of electrical condensers. Although other forms of condensers are mentioned, the chief interest of the communication centres round the rolled paper condenser, in the development of which Mr. Mansbridge has played so active a part. To it we owe the possibility of purchasing condensers for as many shillings to-day as we paid pounds a few years ago. They are made of paper, one side of which is coated with tin mud, which is then dried and burnished. Two sheets of this coated paper are rolled up together, with or without intervening layers of plain paper, and the roll impregnated with hot paraffin wax. A microfarad condenser constructed in this way, and tested by the direct deflection method, the voltage being applied one minute, shows an insulation resistance of 1700 megohms at 100 volts, 1500 at 500 volts, and 200 megohms at 1000 volts.

THE foundations of trigonometry form the subject of a paper by Dr. Arthur C. Lunn in the *Annals of Mathematics* (October). The author points out that in the existing literature of real analysis, the purely logical introduction of circular functions, apart from any appeal to geometrical setting to supply features of the proofs, is mainly accomplished in two ways, one by defining the sine and cosine in terms of their expansions in infinite series, the other by basing the definition on the differentiation formulæ

for the sine and cosine with the special conditions that  $\sin 0 = 0$  and  $\cos 0 = 1$ . Dr. Lunn considers that a more elementary treatment can be obtained by starting from the following postulates, viz. the addition formula for the sines of numbers of the straight-angle set, the continuity of the sine and cosine, the assumptions that  $\cos 90^\circ = 0$   $\sin 90^\circ = 1$ ,  $\cos 180^\circ = -1$ , that  $\cos x$  is not negative between 0 and  $90^\circ$ , and that if  $\sin x/x$  has a limit when  $x$  vanishes that limit is unity. The last assumption is required to determine the unit of angular measurement.

In a paper communicated to the *Rivista marittima* for March last, and reprinted by the Officina poligrafica italiana of Rome (1908), Dr. Filippo Eredia discusses the prevailing winds in the Straits of Messina, and gives statistics of the observations made at various semaphore stations along the Italian and Sicilian coasts.

It was announced in last week's NATURE that on November 28 Mr. Thayer would give a demonstration at the Zoological Gardens of the obliterative effects of the costumes of animals. By an error, which we regret, the date was wrongly printed; it should have been November 18, and not November 28.

MESSRS. ISENTHAL AND CO., 85 Mortimer Street, London, W., have issued a list of precision instruments based on the resonance principle, containing information concerning the frequency and speed meters, as well as other instruments, constructed by them.

WE have received from Prof. W. A. Herdman, F.R.S., a volume containing copies of four addresses delivered by him, in his capacity of president of the Linnean Society, at the anniversary meetings of the society in May of the years 1905-8. The subjects of the addresses were, in the successive years, Linnæus and artificial pearl formation, natural pearl formation, some fundamentals of sea-fisheries' research, and plankton studies in the Irish Sea.

### OUR ASTRONOMICAL COLUMN.

COMET MOREHOUSE, 1908c.—The remarkable changes which have been shown to have taken place in the extent and form of comet 1908c are well illustrated by a series of photographs taken by M. Quénisset at the Juvisy Observatory, and reproduced in the November number of the *Bulletin de la Société astronomique de France*.

Two photographs taken on September 30 with equal exposures showed changes in intensity, but were quite eclipsed by one taken the next night, October 1, between 10h. 48m. and 12h. 55m. The trail of a bright star interferes somewhat with the image of the comet's tail, but, despite this, it is seen that the tail has a large, bright condensation at some distance from the head. From the coma of the comet several narrow, straight streamers emerge, and then suddenly expand into a bright, nebulous mass which continues for some distance with a much greater breadth and diffuseness than the preceding part of the tail. It almost appears as though a tremendous activity of the head had emitted all this matter and had then subsided, leaving only the normal emission of material to form the straight, narrow streamers. This apparently fluctuating activity may easily be explained by assuming that, during its journey through space, the comet encounters meteor swarms of various densities.

These changes may be held to account for M. Bigourdan's widely published statement that, at about the time they were photographed, the comet lost its tail. The visual radiations certainly did decrease in intensity, but the photographic rays were not much fainter; M. Bigourdan's observations were visual.

Some of the photographs show a tail  $17^\circ$  long, that is, actually about twenty-seven million miles (43,000,000 km.), whilst the diameter of the nucleus is  $10'$  of arc, or actually about 290,000 miles (460,000 km.).

Numerous photographs, showing changes similar to

those described above, have also been obtained at the Greenwich and Stonyhurst observatories.

Particulars of the more recent spectrum of the comet are published by MM. Deslandres and Bernard in No. 18 of the *Comptes rendus* (p. 774, November 2). The spectra were obtained with a specially designed spectrograph of 10 cm. aperture and 31 cm. focal length, fitted with an ultra-violet glass objective. A prism of the same glass, having an angle of  $22^\circ$ , was placed in front of the objective, and was, at times, supplemented by another of ordinary flint having an angle of  $61^\circ$ .

The spectra obtained differ on many points from those obtained earlier by Comte de la Baume Pluvinel and described in these columns. The present workers find that the ratio of ultra-violet to visual rays is abnormal, and that the continuous spectrum is very persistent both in the images of the head and of the tail. The hydrocarbon bands, usually a prominent feature of cometary spectra, especially in the green region, are apparently absent, whilst of the numerous cyanogen bands reported by de la Baume Pluvinel only the two first heads of the ultra-violet group, at  $\lambda$  388, were photographed. The three strongest bands appear at about  $\lambda$  456.1,  $\lambda$  426.7, and  $\lambda$  401.3, and are due to some unknown light-source. Many of the bands are double, and MM. Deslandres and Bernard suggest the possibility of this being due to the Zeeman or the Doppler effect, or, maybe, to some new phenomenon special to comets.

A NEW SPECTROSCOPIC LABORATORY AT PASADENA.—Owing to the difficulty of obtaining large supplies of electricity at the Mount Wilson Observatory, Prof. Hale has recently installed a new spectroscopic laboratory at Pasadena, where the laboratory researches necessary for the elucidation of present-day solar problems may be carried out. An illustrated description of the new laboratory appears in No. 3, vol. xxviii., of the *Astrophysical Journal* (p. 244, October).

The main instrument is a 30-feet spectrograph sunk in a waterproof well, 8 feet in diameter, in the concrete floor of the laboratory. The numerous pieces of apparatus for producing radiations are arranged around the well-head, the light being reflected on to the spectrograph slit by a plane mirror. Among the apparatus briefly described in the present note there is an electric furnace capable of withstanding pressures up to 200 atmospheres, and of giving temperatures up to  $3000^\circ$  C.; this is to be employed for studying the spectra of such refractory metals as vanadium and titanium at widely different temperatures. A transformer capable of producing voltages from 1000 to 64,000 has also been installed, whilst a complete outfit for the study of the Zeeman effect in various spectra is intended for the laboratory researches which will naturally follow Prof. Hale's recent and remarkable discoveries in the sun-spot spectrum.

A LARGE GROUP OF SUN-SPOTS.—Another large group of sun-spots, made up of a great number of smaller spots, has recently been seen on the solar disc. This group was first observed at South Kensington on November 6, and was for several days quite easily visible with the naked eye. Another extensive group was first seen, near the limb, on November 12, and was visible to the naked eye on November 17.

BIOGRAPHICAL MEMOIR OF ASAPH HALL.—In April of this year Mr. G. W. Hill read before the National Academy of Sciences, Washington, a biographical memoir of the late Prof. Asaph Hall giving an account of his life and work. This memoir now appears in vol. vi. of the Biographical Memoirs of the society (pp. 241-309), and is accompanied by a valuable bibliography of Prof. Hall's writings, published between 1858 and 1906, to the number of four hundred and eighty-six.

A RESEARCH ON THE MOVEMENT OF COMET WOLF.—The results obtained from the first part of a research into the movement of comet Wolf, undertaken by M. Kamensky, of the Pulkowa Observatory, appear in No. 13 of the *Bulletin de l'Académie impériale des Sciences de St. Pétersbourg* (October, p. 1041). The present results consist of tables for the calculation of the eccentric anomaly, and they may be used in calculating the perturbations of Faye's and Tempel's comets also.